SRI International (Sarnoff)

(Sensei) Technical Report: Distribution A

Sensei: A Multi-Modal Framework for Assessing Stress Resiliency

(February 1-28, 2013)

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Spending for Period 14

1 *Update: Technical Progress and Accomplishments for Period 14 (February 2013):*

Task 3.1: Capture Behavioral Stress Markers in Real-Time in Lab Environment with graded exposure to ICT's scenarios MAC 1-6

Progress during this reporting period was in two primary areas. First, we completed all necessary modifications to our laboratory environment to allow accurate, automatic data collection in Experiment 2. This included:

(1) Enabling full time stamping of all data streams (IR and visible video sensors, plus physiological signals from the Equivital belt).

(2) Developing automatic, trial synced audio recording.

(3) Better illumination to allow pupillometry from the high resolution video camera.

(4) Time-stamping of subject responses to the peripheral detection task.

(5) Python-based automatic start/stop of all data streams.

(6) Automatic generation and population of directories for each data stream for each subject.

In addition to these lab accomplishments, we also fine-tuned the timing of the Stroop/PDT presentations to achieve maximal engagement and hence maximal stress response as the trials come more and more quickly towards the end of the session.

In data analysis, we perfected a technique, described briefly in the last report, for accurately tracking facial feature points in the IR video stream. As shown in Figure 1, this tracking works quite well, even over large facial rotations.

Report Documentation Page

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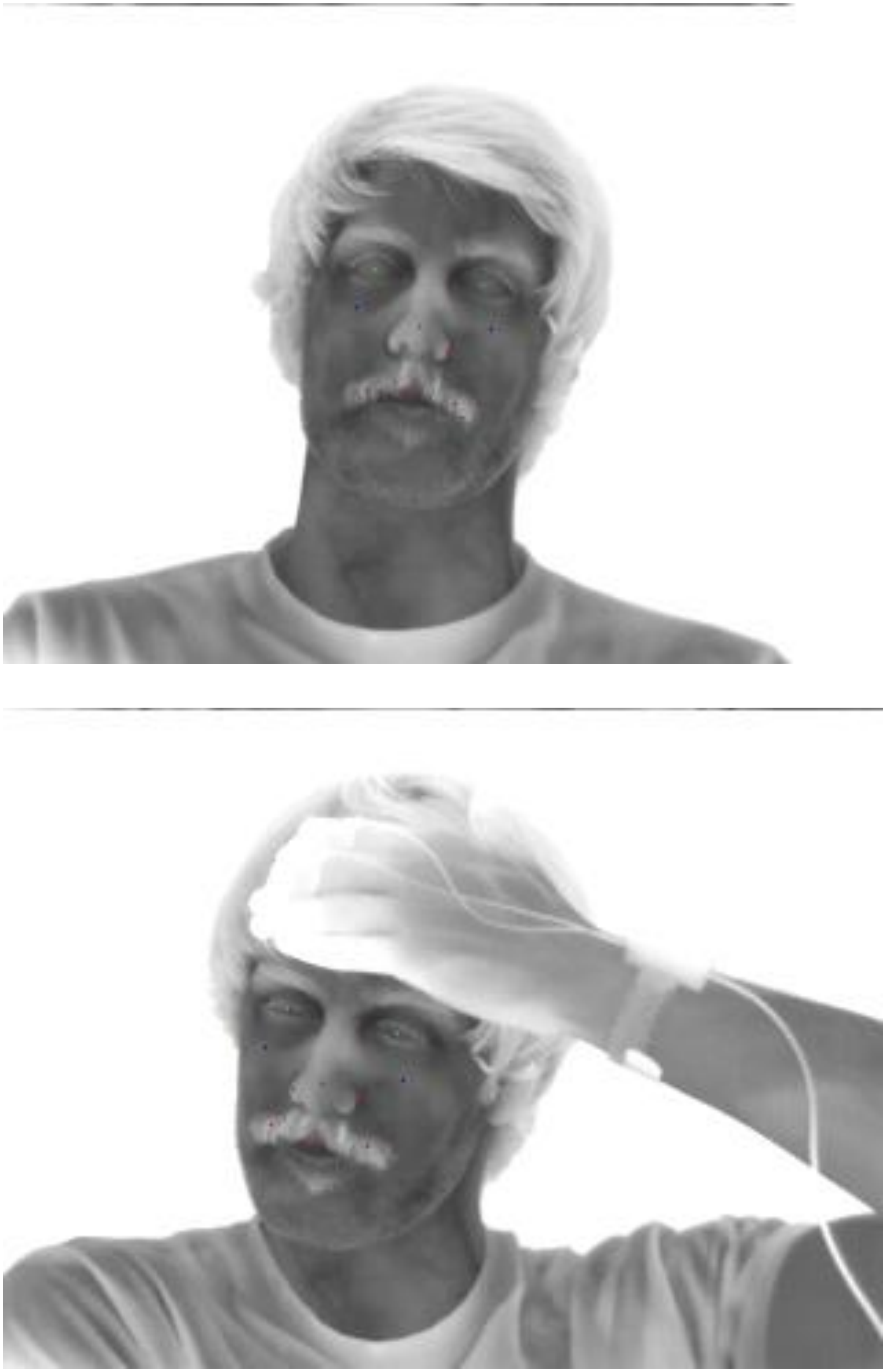

Figure 1. Sample frames from IR video stream, with tracking marks superimposed

The tracking works so well, in fact, that we now intend to perform facial expression analysis primarily from the IR stream, with the high resolution video stream reserved primarily for pupillometry and gaze analysis.

As an example of the utility of this high quality tracking, we implemented a technique to measure breathing rate based on observable temperature changes around the nostrils. The technique uses a barycentric approach to determine if a pixel is inside a polygon formed from a set of six tracked points around the nostrils, and then computes a mean value within this polygon. These points include those labeled 9.3, 9.1, 9.5, 9.15, 9.4, and 9.2 in Figure 2 below.

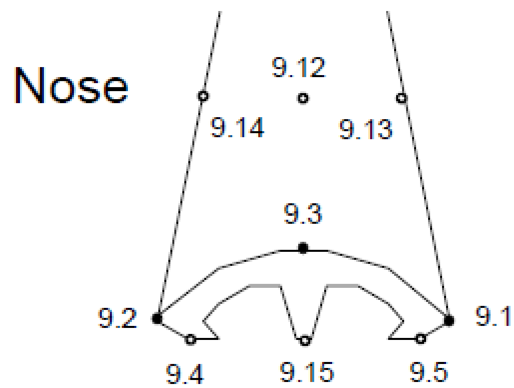

Figure 2. Tracked points used for inhale/exhale detection

Figure 3 below shows the result of this computation for a representative sequence of frames. Each inhale/exhale cycle is very clearly evident in this figure.

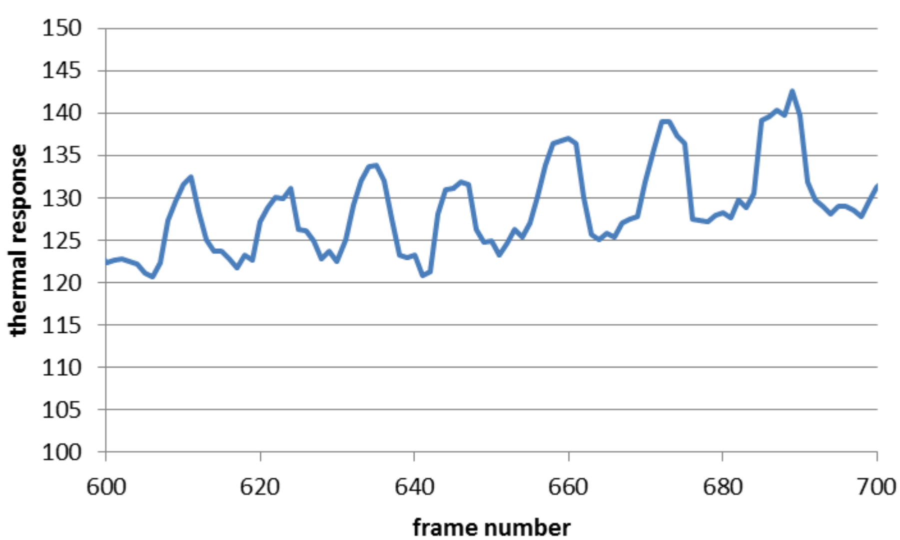

Figure 3. Breathing rate measurement example

Based on the success of this approach, we intend to also implement heart rate monitoring in an analogous fashion.

Task 3.2: Administer Scenarios and Verify Hypothesis MAC 6-12

Not yet at this stage.

Task 3.3: Program Management MAC 1-12

2. ***Issues:***

- No current issues.

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